# A latent growth curve (LGC) analysis to dissociate components of response time (RT) variance

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## Introduction

- RT on more demanding cognitive tasks predicts psychometric intelligence (*g*) better than RT on less demanding ones.
- Irrespective of task demands, the worst performance rule (WPR) states that the correlations between individual-level worst performance (i.e., slowest RTs) and *g* are larger than between individual-level best performance (i.e., fastest RTs) and *g*.
- The WPR effect was found to be more pronounced with more demanding tasks. However, neither best performance nor demand-independent variance were controlled for.
- In the present study, therefore, we employed two-level LGC to dissociate worst and best performance, in a first step, and variance due to task demands from demand-independent variance, in a second one.

## Method

*Participants* were 228 volunteers ranging in age from 17 to 41 years (mean age ± SD = 22.9 ± 3.3 years).
*Hick Task.* There were three levels of task complexity (see Figure 1). Participants had to press a response button corresponding to the stimulus position. Each condition consisted of 32 trials. As an indicator of performance, median RT was computed.
*Intelligence*. Psychometric *g* was extracted from the four subtests of Cattell's Culture Fair Test (CFT-20).

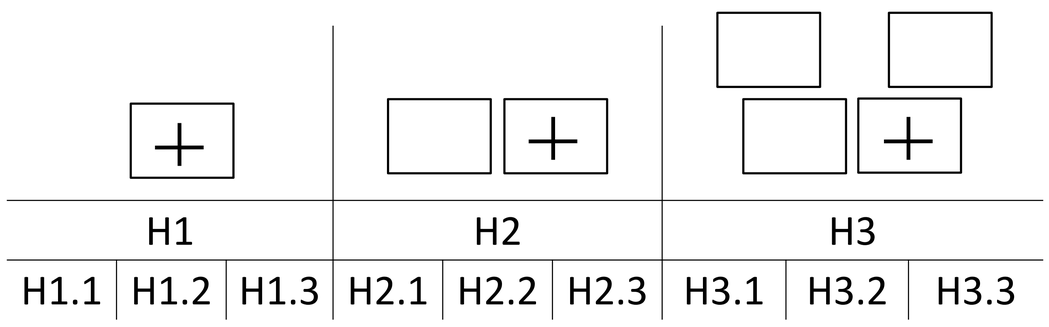


***Figure 1***. *Hick task. H1, H2, H3 = simple, two-choice, four-choice reaction time task. Each task is parceled into three RT bands represented by the attached index: .1 = best performance, .2 = moderate performance, .3 = worst performance.*

## Results

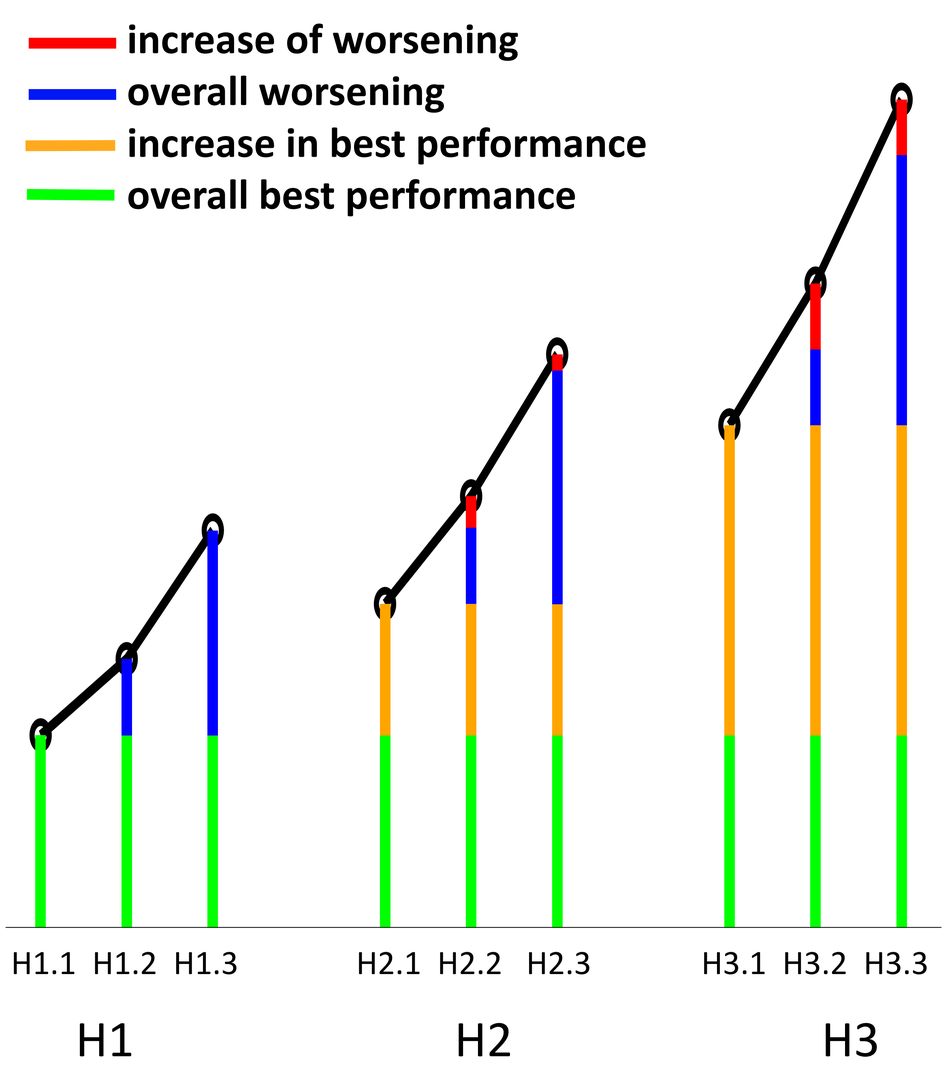


***Figure 2***. *Reaction time components dissociated by means of latent growth curves.*

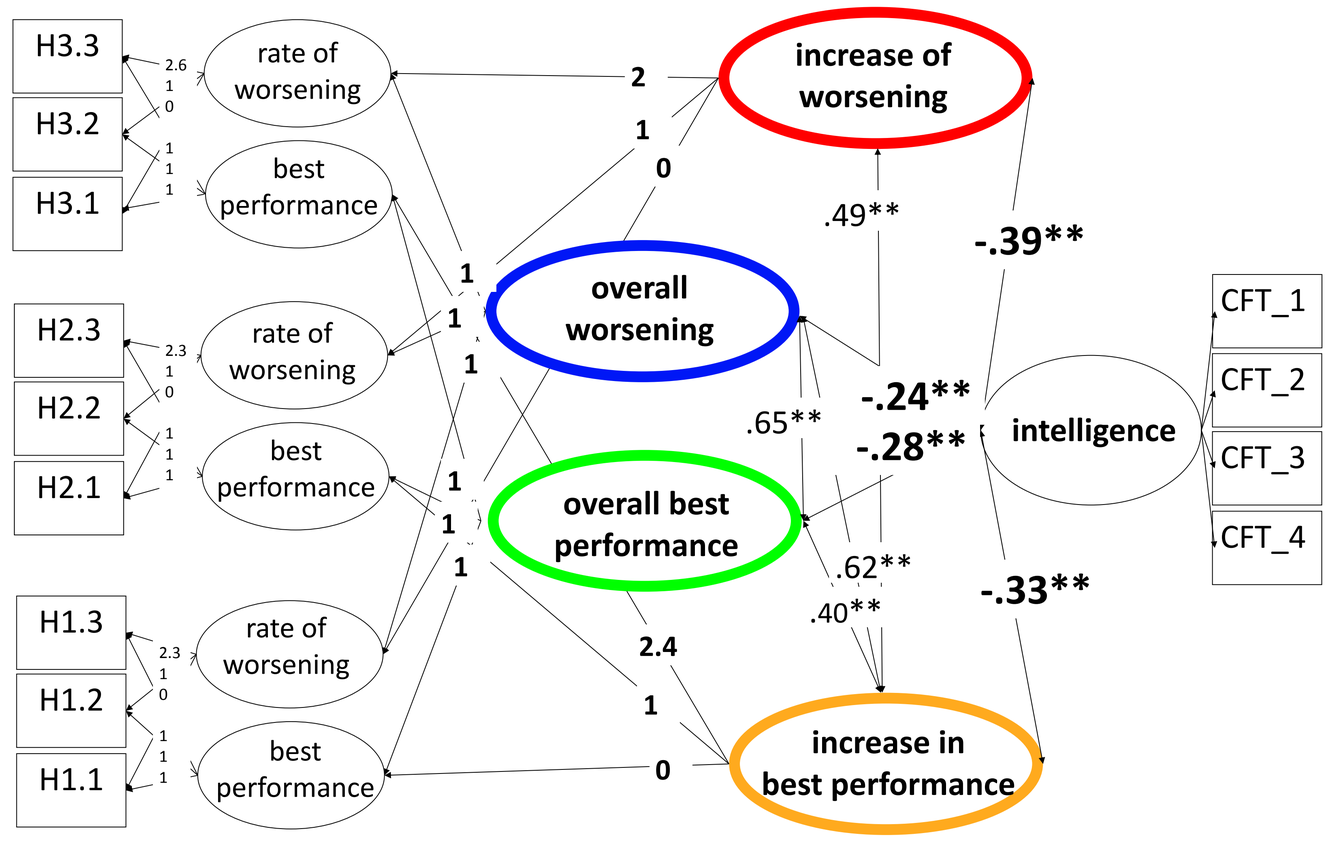


***Figure 3***. *Latent growth curve modeling of Hick data.*

***Table 1***. *Summary of fit statistics for the latent growth curve model.*

| $X^2$ | df | *p* | *SB* | CFI | RMSEA | 90% C.I. of RMSEA |
|---|---|---|---|---|---|---|
| 63.267 | 56 | .235 | 1.7 | .99 | 0.024 | .0 - .044 |

Notes : *SB = scaling correction (Satorra-Bentler); CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation;*

## Conclusions

- The LGC model is a useful approach to dissociate worst and best performance as well as task demands and demand-independent variance.
- The WPR effect was shown to be more pronounced in more demanding tasks when controlled for best performance and demand- independent variance.

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